Eelgrass (*Zostera marina*) locations in Newfoundland and Labrador

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2014

Canadian Technical Report of Fisheries and Aquatic Sciences 3113

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Canadian Technical Report of Fisheries and Aquatic Sciences

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Canadian Technical Report of
Fisheries and Aquatic Sciences 3113

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EELGRASS (*ZOSTERA MARINA*) LOCATIONS IN NEWFOUNDLAND AND LABRADOR

by

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Cat. No. Fs97-6/3113E-PDF ISBN 978-1-100-25416-6 ISSN 1488-5379

Correct citation for this publication:

Rao, A.S., R.S. Gregory, G. Murray, D.W. Ings, E.J. Coughlan and B.H. Newton. 2014. Eelgrass (*Zostera marina*) locations in Newfoundland and Labrador. Can. Tech. Rep. Fish. Aquat. Sci. 3113: vi + 19 p.

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ABSTRACT

Rao, A.S., Gregory, R.S., Murray, G., Ings, D.W., Coughlan, E.J. and Newton, B.H. 2014. Eelgrass (*Zostera marina*) locations in Newfoundland and Labrador. Can. Tech. Rep. Fish. Aquat. Sci. 3113: vi + 19 p.

Eelgrass (*Zostera marina*) has been identified as an Ecologically Significant Species in Canada. In contrast to widespread declines of eelgrass abundance and distribution reported worldwide, including locations elsewhere on the North Atlantic coast, expansions have been reported in at least some parts of the Province of Newfoundland and Labrador. Mapping efforts were undertaken on the Newfoundland and Labrador coast between 1996 and 2006 by Fisheries and Oceans Canada, the Memorial University of Newfoundland Coasts Under Stress project and by independent researchers. Eelgrass locations were identified around the Island of Newfoundland and along the coast of southern Labrador. This technical report combines the data sets from those efforts to present the first comprehensive map of known and potential eelgrass locations in the province. Ground-truthing has demonstrated the utility of these data sets, and the methods used to obtain them, in predicting eelgrass locations.

RÉSUMÉ

Rao, A.S., Gregory, R.S., Murray, G., Ings, D.W., Coughlan, E.J. and Newton, B.H. 2014. Emplacements de zostères (*Zostera marina*) à Terre-Neuve-et-Labrador. Can. Tech. Rep. Fish. Aquat. Sci. 3113: vi + 19 p.

La zostère (*Zostera marina*) a été désignée comme une espèce d'importance écologique au Canada. Contrairement au déclin généralisé dans l'abondance et la répartition des zostères qui a été signalé à l'échelle mondiale, y compris ailleurs sur la côte de l'Atlantique Nord, une croissance a été signalée dans certaines parties de la province de Terre-Neuve-et-Labrador, à tout le moins. Entre 1996 et 2006, des efforts de cartographie sur la côte de Terre-Neuve-et-Labrador ont été entrepris par Pêches et Océans Canada et des chercheurs indépendants ainsi que dans le cadre du projet « Coasts Under Stress » de l'Université Memorial. Des emplacements de zostères ont été déterminés autour de l'île de Terre-Neuve et le long de la côte sud du Labrador. Le présent rapport technique combine les ensembles de données tirés de ces efforts afin de présenter la première carte complète des emplacements connus et possibles de zostères dans la province. La vérification au sol a démontré l'utilité de ces ensembles de données et des méthodes utilisées pour les obtenir dans la prédiction des emplacements de zostères.

INTRODUCTION

Globally recognized ecosystem services provided by seagrasses include primary productivity, nutrient cycling and mitigation of coastal eutrophication, sediment stabilization, carbon sequestration and food for herbivores (Kenworthy et al. 1982, Hemminga and Duarte 2000, Kenworthy et al. 2006, Orth et al. 2006). They also provide nursery and other critical habitat for a variety of animals, including commercially important fish (Hemminga and Duarte 2000, Beck et al. 2001, Kenworthy et al. 2006). Seagrasses were traditionally used by people in the North Atlantic and Northeast Pacific for food and food processing, medicine, insulation, coverings, toys, bedding, mulch, sealants, markers and ceremonies (Wyllie-Echeverria et al. 2000).

Seagrasses are found worldwide but only one species – eelgrass, *Zostera marina* L. – is widespread in Atlantic Canada. The species is also locally referred to as cord grass and goose grass. Eelgrass is a common and highly productive perennial aquatic plant which grows in intertidal and subtidal beds in estuaries and coastal areas with modest annual sediment deposition derived from terrestrial runoff. The plants grow as small discrete patches of a few plants up to large monoculture meadows covering several hectares.

Eelgrass has been recognized by Fisheries and Oceans Canada (DFO) as possessing characteristics meeting the criteria of an Ecologically Significant Species (DFO 2009) - a species whose loss would carry with it a disproportionately greater impact on the provision of ecological services than other components of the ecosystem (DFO 2009). The identification of eelgrass as an Ecologically Significant Species was intended to increase awareness among managers of its ecological importance and to suggest an increase in due diligence with respect to human activities potentially affecting this species (DFO 2009).

The importance of eelgrass as habitat to small-bodied fishes along the Newfoundland coast has been repeatedly demonstrated, including its role as nursery and rearing habitat for important commercial finfish species such as Atlantic Cod (*Gadus morhua*; Gotceitas et al. 1997, Grant and Brown 1998, Laurel et al. 2003, Laurel et al. 2004, Warren et al 2010). In these studies, age 0+ cod were found almost exclusively in eelgrass, compared to non-vegetated seabeds, primarily using the plant to hide from predators (Gorman et al. 2009). The importance of eelgrass habitat to the fish community as a whole has received little attention in Atlantic Canada, although studies which do exist suggest similar ecosystem functions (Joseph et al. 2006, DFO 2012, Joseph et al. 2013), including community stabilizing effects (Cote et al. 2013).

Stressors may alter, disrupt or destroy eelgrass habitat value. Although the thresholds for alteration and disruption remain uncertain, it is known that increased stress can reduce density and coverage of eelgrass, and increase patchiness (DFO 2012).

Declines in eelgrass distribution and abundance have been recorded in much of Atlantic Canada (Hanson 2004). In certain areas of Newfoundland, however, the plant may be expanding its distribution in the nearshore (Warren et al. 2010). Observed regional declines may be attributed to geographically specific or synergistic factors, including disturbance by the invasive green crab (*Carcinus maenas*) or eutrophication (Hanson 2004). Recently established populations of green crab in Placentia Bay, Newfoundland appear to be expanding their distribution within the bay and also establishing in other bays. The potential negative effects of this invasive species on eelgrass habitat and the cascading influence on fish production can be locally substantive (Morris et al. 2011). The cumulative effects of potential expansion of eelgrass distribution and abundance on the one hand and invasive species on the other, have yet to be assessed in the context of eelgrass conservation in Newfoundland and Labrador. The establishment of a baseline understanding of eelgrass distribution in the province is an important step to support such assessments.

Mapping and monitoring seagrass beds can enable a better understanding of their status and can serve an important role in stewardship and management efforts (e.g. Boyer et al. 2009). Although detailed eelgrass mapping and monitoring efforts have been developed (Precision 2002) and are widespread on the Pacific coast of Canada (BCMCA 2011, PNCIMA 2011), and some mapping has been undertaken on the Atlantic coast (Hanson 2004), knowledge of eelgrass distribution has been incomplete in Newfoundland and Labrador coastal waters prior to this time.

Several independent mapping efforts targeting eelgrass presence were undertaken in various locations throughout Newfoundland and Labrador between 1996 and 2006 which, when taken as a whole, can provide near-complete coverage of the entire Island of Newfoundland and the southern portions of Labrador. This project merged these disparate data sources to produce the first comprehensive single map of known and potential eelgrass occurrence along the Newfoundland coast. It is anticipated that this composite map is sufficient as a first estimate of eelgrass locations to inform future, more detailed mapping projects, research and analysis.

Information sources included: high altitude aerial photos and satellite images, low level aerial photos, surveys from small boats, visual onsite inspections from shore, and local ecological knowledge. This information has been of varying quality and some is dated. Detection of eelgrass may have been affected by tide state, water clarity, season, and observer experience. Generally, the distribution and abundance of eelgrass based on these surveys are believed to be underestimated. To our knowledge, no areal coverage estimates have been attempted in Newfoundland except in a small number of individual embayments (e.g., Newman Sound and St. George's Bay).

METHODS

The geographic focus for this eelgrass mapping compilation was the Province of Newfoundland and Labrador; although the greatest effort was expended on the coast of the Island of Newfoundland, where the plant is a more common component of the ecosystem.

Eelgrass locations in several regions within the province were identified as part of three distinct projects between 1996 and 2009. The methods used in those projects involved local ecological knowledge (LEK), satellite imagery analysis, aerial photo analysis and ground-truthing. These disparate sources were combined to develop a composite map showing all the areas of eelgrass identified in the province. The data were obtained at a variety of scales, therefore the composite map is of a coarse scale.

Although the utility of distinguishing between known and potential eelgrass sites would be a useful analysis, this was not within the scope of the research presented in the composite map.

The four projects integrated into the composite map were as follows, and are described in more detail below:

1. The Coastal Community Resource Inventory (CCRI) of Fisheries and Oceans Canada - a dataset documenting local ecological knowledge (LEK) of fisheries resources in coastal areas throughout the province (1990s),
2. a) Satellite imagery and analysis of aerial photos (1996-2009);
   b) Ground-truthing of satellite imagery and aerial photo analysis obtained through field research and spatially focused coastal surveys on eelgrass habitats in Bonavista Bay, Trinity Bay, and Notre Dame Bay (2006-09);
3. Field surveys of eelgrass distribution in Trinity Bay and Placentia Bay (2006); and
4. Local ecological knowledge (LEK) of eelgrass distribution under the Coasts Under Stress interdisciplinary research program of Memorial University of Newfoundland (2000-05).

1. <u>Coastal Community Resource Inventory (CCRI)</u>

   LEK of eelgrass locations was collected beginning in 1996 through interviews with individuals in coastal communities. This information, as collected during the CCRI, is qualitative and anecdotal. Interviewees included active and retired fishers, as well as other individuals with relevant resource knowledge. The methodology has been reported in O'Brien et al. (1998).

   The distribution of potential eelgrass areas was identified by synthesizing LEK detailed in the CCRI database for the entire province, as well as satellite imagery (from Google Earth), and aerial photography from the

Province of Newfoundland & Labrador Archives for Trinity Bay and along the western coast of Newfoundland - areas of the island easily accessed by the team for ground-truthing.

Digital images of eelgrass locations from the CCRI were obtained from the DFO GeoBrowser (v. 5.0) (http://geoportal-geoportail.gc.ca/dfoGeoPortal/) and georeferenced into the composite map.

2. Satellite Imagery and Aerial Photos

Satellite imagery from public domain mapping tools (Google Earth) was examined in the entire contiguous area of Trinity Bay, and the west coast of Newfoundland and southern Labrador (Cape Ray to Cape St. Charles) to identify potentially suitable locations for eelgrass growth based on shoreline configuration and shape. Where image resolution permitted (almost the entire study area), areas showing promise were further examined with mapping tools to determine candidate areas which had a high likelihood of eelgrass presence. Where image resolution was poor, areas showing promise were qualitatively assessed and subjectively assigned to categories of likelihood of eelgrass presence. Those sites in the highest likelihood category were considered candidate areas similar to those identified above using Google Earth. Candidate areas were examined in further detail using available aerial photographic imagery from Newfoundland and Labrador provincial archive sources (NL Government - Howley Building, Higgins Line, St. John's, NL) to identify potential eelgrass beds based upon topography and shoreline exposure. In some such cases, eelgrass meadows themselves were identified from these aerial photos.

2b) Ground-truthing of Potential Eelgrass Sites

After mapping candidate eelgrass areas via CCRI and/or satellite and aerial photographs, selected sites were ground-truthed, depending on their accessibility by shore-based survey teams. These sites were evaluated to confirm predictions of eelgrass habitat originally based upon the Google Earth imagery or the aerial photos from the Newfoundland Provincial Archives. For example, in 2006 ground-truthing inspections were conducted by boat at 20 coastal sites in Trinity Bay identified as having a high likelihood of eelgrass presence. A similar procedure was used in 2009 to ground-truth candidate areas in western Newfoundland. In several sites, shore-based visual inspection was augmented by detailed visual surveys by boat (e.g., Newman Sound, Leading Tickles) and scuba diving (e.g., Newman Sound, Bonavista Bay; Two Gut Pond, Port au Port Peninsula; and Port Saunders, Northern Peninsula).

In Newman Sound, low altitude (~225 m) aerial photog
raphy was used to provide detailed mosaics of selected sites at low tide, which were then ground-truthed using scuba diving transects and video camera imagery (see Warren et al. 2010).

Geographic information systems (GIS) shape files of eelgrass areas in Newman Sound were integrated into the composite map.

3. Field Surveys of Eelgrass Distribution in Trinity Bay and Placentia Bay

Trinity Bay and Placentia Bay were identified as priority areas for additional comprehensive surveys in 2006 as they were the locations of active DFO research. Placentia Bay was also the pilot area for Integrated Coastal Zone Management efforts.

Potential holders of LEK about eelgrass locations around Trinity and Placentia Bays were identified by representatives of DFO, Newfoundland and Labrador Department of Fisheries and Aquaculture (DFA) and the Fish, Food and Allied Workers union. Meetings or telephone conversations were held with available individuals, who were asked to highlight potential eelgrass areas on a bathymetric map, or describe their possible locations.

In addition to the information obtained from LEK, potential eelgrass sites in Trinity Bay and Placentia Bay, as well as limited sites in St. Mary's Bay and Fortune Bay, were identified on 1:250,000 bathymetric maps (Canada 1971) based on the convergence of the following indicators: sheltered coastline, based on the degree of convolution of the coastline; presence of a freshwater input; and depth less than 30 m (Duarte 1991).

Potential or known eelgrass sites identified by knowledge holders and through bathymetric map analysis were ground-truthed from land to determine the presence or absence of eelgrass in the vicinity. Eelgrass was assessed as present in the area if live eelgrass was observed, or if eelgrass was washed up along the shoreline. Geographical coordinates were obtained at each site, and were uploaded into the composite map.

4. Coasts Under Stress

The Coasts Under Stress (CUS) program focused on the Atlantic and Pacific coasts of Canada to analyze impacts of social-ecological restructuring on health of people, their communities and the environment. The methodology is fully described in Murray et al. (2006, 2007, 2008 a,b); we provide a summary here. CUS study sites included the west coast of Newfoundland and southern coastal Labrador. One of the projects that made up this program involved gathering LEK from fish harvesters regarding eelgrass distribution and a range of other environmental features, as well as other information related to social-ecological restructuring.

Eelgrass locations were compiled in 2003-2005 (with most data collected in 2003-2004) for the west coast of Newfoundland from Port aux Basques around the northern peninsula to Main Brook, just south of St. Anthony; and the coast of Labrador from Blanc Sablon to Cartwright. Local experts were identified through guidance from field representatives of the DFA and local fisheries committees. LEK holders were distributed throughout the

study area, with some concentration in areas where fisheries were particularly intensive. Most interviews were with retired or nearly retired harvesters.

Fish harvesters' LEK was gathered through semi-structured interviews, guided by an interview schedule. Nautical charts were used to help structure the conversation, and to tie observations to places as appropriate. Information shared by each individual harvester was at a local scale; harvesters were asked to describe areas with which they had familiarity. These included their home communities, home ports or fishing areas.

Interviews were recorded and transcribed, and nautical charts were marked with locations of eelgrass (and other features) by either the respondent or interviewer. Interview transcripts were organized using a combination of Excel and Nud*ist (N6). Charts resulting from interviews were digitized using MapInfo (GIS) software. Transcript and map databases were linked using a series of identifying codes. Eelgrass information collected during the interviews has not been published elsewhere.

GIS shape files of eelgrass areas identified through these interviews were integrated into the composite map.

RESULTS

The four data sets containing eelgrass locations around Newfoundland and Labrador were compiled into a single map (Figure 1). Eelgrass locations have been identified around the island of Newfoundland and in southern Labrador. Our results suggest that eelgrass is known or likely to be distributed in the marine coastal zone of areas around the entire island of Newfoundland. The figure does not distinguish between known and potential sites.

Multiple methods were used to create the map in Figure 1, but the resulting coarseness is sufficient for the map's intended purpose - a first estimate to inform more detailed mapping projects in the future.

The resolution of the map and scale of the methods used do not enable precise delimitations of eelgrass beds. The exception is in Newman Sound, where detailed mapping has been undertaken. The resolution of the figure in this published format does not enable precise presentation of those data; however, the detailed shapefiles were used for its creation. Polylines represent observed alongshore continuity of eelgrass, but do not imply seaward extent.

Eelgrass was confirmed by ground-truthing to be present in 17 (71%) of 24 sites identified as high probability areas using Google Earth satellite imagery and 13 (87%) of 15 sites identified as high probability areas based on combined team

experience and CCRI documentation. Satellite imagery and CCRI documentation were used to estimate probability of eelgrass presence but not probability of eelgrass absence. Low, medium and high probability of eelgrass presence was estimated using aerial photos. Aerial photo analysis was confirmed through ground-truthing to be "correct" (low estimated probability = absent through ground-truthing, medium = present, high = present) at 7 (58%) of the 12 aerial photo sites ground-truthed. Data and location coordinates are provided in Table 1. The CCRI dataset was a reliable guide in the areas in where eelgrass was identified by LEK as present, but not for confirming its absence.

DISCUSSION

Preliminary work has been completed to identify eelgrass locations throughout Newfoundland and Labrador. This is the most comprehensive map of eelgrass locations to date in the province. Anecdotally, we observed that eelgrass is likely to be present along sheltered areas of the coast, extending from the mean low tide mark (below depths sustaining substantial winter ice damage) to as deep as 10 m in areas which receive at least a modest fresh water input annually. Testing such observations explicitly was beyond the scope of our project, but they could be verified through further research. Eelgrass almost certainly forms only a relatively small (~<2% of the coast) but valuable proportion of coastal habitat. It can be found either as discrete patches in a mud/gravel matrix or as large monoculture meadows.

The distribution of eelgrass in Newfoundland waters is constrained by physical coastal features and the extent of sea ice scour (DFO 2009). It may also be constrained by lack of adjacent areas with populations that could provide seeds or lateral expansions of roots and rhizomes. Coastal developments and activities may also affect eelgrass distribution (Burdick and Short 1999, DFO 2012).

The confidence with which eelgrass locations were observed through ground-truthing following identification of candidate areas from satellite imagery suggests that it is reasonable to identify likely eelgrass habitat based on these resources alone. That level of analysis is also useful to provide a starting point to guide and focus more detailed studies. The CCRI dataset in particular was confirmed as useful, albeit non-exhaustive, guidance to areas where eelgrass is present.

Absence of eelgrass on the map may reflect lack of local knowledge moreso than the actual absence of eelgrass. For example, eelgrass locations have not been identified on much of the south coast of Newfoundland. That area is sparsely inhabited and local fishers are more likely to work away from shore rather than close to coastal shallows where eelgrass grows. For these reasons, local familiarity with eelgrass and its location may be limited. Limited knowledge of the plant may prevent its identification even when it is observed. For example,

some interviewees in Trinity and Placentia Bays categorized eelgrass and algae under the generally-applied term "kelp".

The scale of effects of eelgrass may not be confined to those areas shown on the map. That is, the presence of eelgrass beds creates physical and biological effects beyond their extent, including nutrient cycling (Flindt 1994), support for fish communities (Gotceitas *et al.* 1997, Joseph *et al.* 2013), food for herbivores (e.g. Seymour *et al.* 2002), carbon sequestration (Kennedy *et al.* 2010) and sediment stabilization (Orth 1977).

Increased understanding of eelgrass distribution, abundance and changes over time in Newfoundland and Labrador will inform climate and environmental monitoring efforts, industrial development applications and environmental assessments, land and marine use planning, and conservation and environmental management efforts.

Specific follow-up to this initial coarse-scale map may include additional presence-absence mapping to cover unstudied areas, as well as more detailed mapping of individual eelgrass beds as per the methodology currently used on the Pacific Coast of Canada (Precision 2002). In addition, detailed and regular mapping of distribution, extent and density would enable monitoring of trends.

Supplementary maps are available showing the locations of land and marine uses including locations of sewage outfalls, aquaculture, fish plants, mines and harbours relative to the locations of eelgrass in Placentia Bay as of 2007 (Rao, unpublished data). Similar analyses may be done in other areas. The map presented in Figure 1 may also be superimposed on known locations used by juvenile fish to determine its utility in predicting important fish habitat.

Eelgrass distribution as represented by this map may change as a result of climate change, particularly increased ocean temperatures. Our map provides a baseline record of where eelgrass currently exists or has the potential to exist, which will be a useful reference for comparison to future observed distribution. For example, eelgrass was expected at Pistolet Bay on the Northern Peninsula based on bathymetry, but it was not observed at this location. Temperature and exposure may be limiting factors in that location. Pistolet Bay is an example of a site that may be a useful reference location for climate change monitoring purposes.

Monitoring of eelgrass extent relative to green crab invasion or eradication may also provide an indication of green crab's cascading effects. These influences may not be limited to eelgrass, but also the wider ecosystem, including commercially important fish species (Morris *et al.* 2011).

ACKNOWLEDGMENTS

Financial support for this project was provided by Fisheries and Oceans Canada, the Walter and Duncan Gordon Foundation and the Coasts Under Stress Network project under the Social Sciences and Humanities Research Council, the Natural Science and Engineering Research Council of Canada and its collaborating member universities, and partners in federal and provincial governments, First Nations, business and non-governmental organizations. Comments and additions to an earlier draft by T. Bowdring, K. Dalley, L. Sheppard and N. Templeman, improved the final manuscript.

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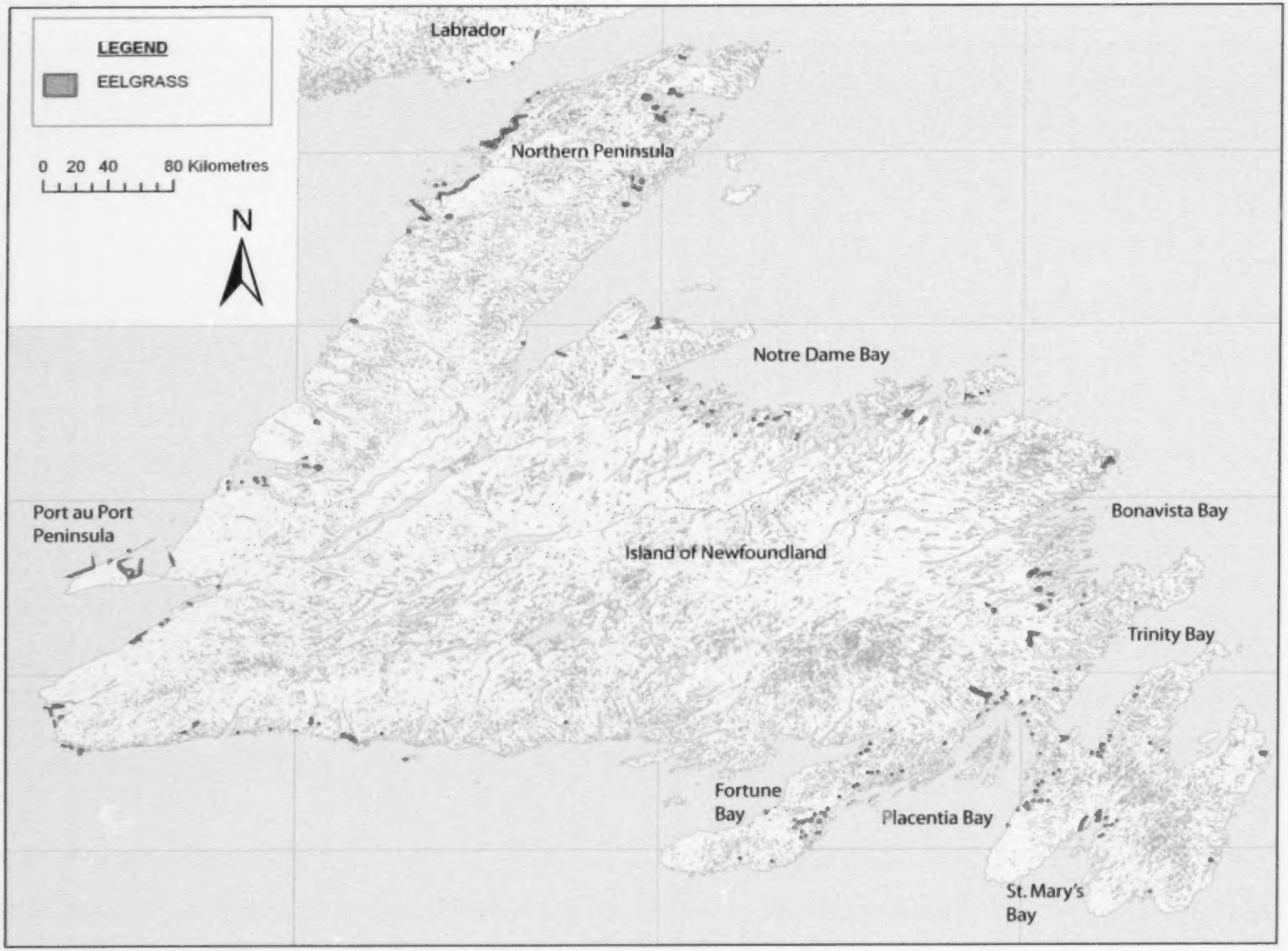

Figure 1. Known and potential eelgrass locations in Newfoundland and Labrador

Table 1. Evaluation of potential eelgrass sites identified from coastal topography (Google Earth™), Community Coastal Resource Inventory (CCRI - Fisheries and Oceans Canada), aerial photos (Province of Newfoundland and Labrador archives) and select ground-truthing in western Newfoundland, southern Labrador and Trinity Bay, 2006-09.

Site #	Geographic Location			High Potential Eelgrass Sites					
	Location (nearest community)	Latitude dd mm ss.ss	Longitude Dd mm ss.ss	Google Earth Satellite Imagery	CCRI[1]	Aerial Photographs			Ground truthing P/A[4]
						Flight Line (if available)[2]	Photo Reference No.	Eelgrass Presence H/M/L[3]	
	Western Newfoundland								
1	Cape Ray	47 37 30.44	59 16 03.71	High	–	97012	111-113	L	
2	Cape Ray	47 37 42.94	59 16 55.58	High	–	97012 31511	118-120 7-13	L	
3	St. Andrew's	47 45 29.15	59 18 08.28	High	Y				
4	Searston	47 50 01.33	59 19 52.64	High	–				
5	Shoal Point	47 52 32.16	59 24 00.03	High	–	97026	65-66	M	
6	Flat Bay West	48 23 59.98	58 36 47.84	High	–				
7	Flat Bay West	48 25 13.16	58 35 48.43	High	–	97014	186-187	H	
8	Flat Bay	48 24 18.97	58 34 46.88	High	Y	97014	183-184	H	
9	St. George's	48 27 04.58	58 29 49.11	High	–	97003	105-107	H	
10	St. George's	48 25 55.31	58 28 39.64	High	–		205	H	
11	Stephenville Crossing	48 29 06.93	58 25 52.22	High	–	97009	168-169	M	
12	Stephenville Crossing	48 30 55.34	58 28 06.49	High	–	97009	48-50	M	
13	Stephenville Crossing	48 30 27.09	58 29 28.70	High	–	97009	48-50	M	
14	Stephenville	48 31 36.03	58 32 06.99	High	–	97009 97014	45-46 19-20	H H	

Site #	Geographic Location			High Potential Eelgrass Sites					
						Aerial Photographs			Ground truthing P/A[4]
	Location (nearest community)	Latitude dd mm ss.ss	Longitude Dd mm ss.ss	Google Earth Satellite Imagery	CCRI[1]	Flight Line (if available)[2]	Photo Reference No.	Eelgrass Presence H/M/L[3]	
15	Port Au Port	48 33 52.78	58 53 34.43	High	Y	97001	201-206	L	
16	Port Au Port	48 33 34.88	58 43 35.64	High	-	97013	76-78	L	
17	Two Gut Pond	48 38 39.62	58 40 00.60	High	Y	97004	1-2	H	
17	Two Gut Pond	48 38 39.62	58 40 00.60	High	Y	97004	117-118	H	
18	Fox Island River	48 41 45.18	58 40 44.17	High	-				
19	Lark Harbour	49 05 12.44	58 21 45.47	High	-	01009	30-31	M	
20	McIvers	49 04 25.98	58 07 42.85	High	-	01009	41	M	
21	Corner Brook	48 57 52.14	57 54 04.93	High	-	01002	40-41	L	
22	Corner Brook	48 59 01.18	57 54 37.47	High	-				
23	Cox's Cove	49 06 52.17	58 03 04.62	High	-	01009	8-10	M	
24	Goose Arm	49 10 20.52	57 51 36.44	High	Y				
25	Glenburnie	49 26 22.82	57 53 12.24	High	Y	93004	65-66	L	
26	Gros Morne Park	49 27 12.71	57 44 53.40	High	-				
27	Gros Morne Park	49 27 30.02	57 42 41.66	High	-				
28	Norris Point	49 31 27.20	57 52 51.36	High	-	93004	29-31	M	
29	Norris Point	49 33 41.18	57 50 03.59	High	-				
30	Rocky Harbour	49 35 21.38	57 55 11.31	High	-	93004	8-10	L	A
31	St. Paul's	49 51 46.98	57 48 25.61	High	-	93003	27-28	H	
32	Parson's Pond	50 01 35.83	57 42 29.70	High	-	31511	146-148	H	P
33	Portland Creek	50 10 46.30	57 36 25.81	High	-				
34	River of Ponds	50 32 52.83	57 23 16.38	High	-	95007	127-129	L	
35	River of Ponds	50 34 11.03	57 23 30.06	High	-	95007	127-129	L	
36	Hawks Bay	50 36 38.30	57 10 15.00	High	-	95042	77-78	M	P
37	Hawks Bay	50 36 57.00	57 09 53.40	High	-	95042	77-78	M	A
38	Port Saunders	50 38 29.12	57 14 42.35	High	-				

Site #	Geographic Location			High Potential Eelgrass Sites					
						Aerial Photographs			
	Location (nearest community)	Latitude dd mm ss.ss	Longitude Dd mm ss.ss	Google Earth Satellite Imagery	CCRI[1]	Flight Line (if available)[2]	Photo Reference No.	Eelgrass Presence H/M/L[3]	Ground truthing P/A[4]
39	Port Au Choix	50 42 26.41	57 21 02.65	High	–	95043	30-31	M	
40	Castor's River	50 55 00.25	56 56 50.78	High	–	93009	80-82	H	
41	Reef's Harbour	51 00 46.80	57 00 21.61	High	–	93010	93-95		
42	Plum Point/ St. Genevieve	51 05 11.26	56 52 14.35	High	Y	95003	76-77	L	
43	River/ St. Barb	51 08 10.90	56 47 48.70	High	Y	95006	67-68	M	A
44	Black Duck Cove/ St. Barb	51 11 23.98	56 46 00.74	High	–				A
45	Black Duck Cove	51 12 29.43	56 44 26.78	High	–	95013	155-157	M	A
46	Flower's Cove	51 18 01.68	56 41 35.42	High	–	95014	71-72	L	
47	Savage Cove	51 19 38.50	56 41 35.42	High	–				
48	Big Brook/ North Boat	51 31 17.15	56 08 52.50	High	–	95004	95	L	
49	Harbour	51 35 24.83	55 59 12.30	High	–	95004	27-28	M	
50	Cook's Harbour	51 36 30.14	55 52 59.84	High	–	95004	11-12	L	
51	Shallow Bay	51 32 46.98	55 52 59.53	High	–	95004	72-74	M	
52	Northern Peninsula Area	51 29 50.64	55 52 02.93	High	–	95009	155-157	L	
53	Northern Peninsula Area	51 29 47.98	55 40 56.99	High	–	95004	151-152	L	
54	Raleigh	51 34 01.79	55 38 28.06	High	–	95009	12-14	L	
55	Quirpon	51 35 35.25	55 28 29.02	High	–	95009	114-115	L	

Site #	Geographic Location			High Potential Eelgrass Sites					
						Aerial Photographs			
	Location (nearest community)	Latitude dd mm ss.ss	Longitude Dd mm ss.ss	Google Earth Satellite Imagery	CCRI[1]	Flight Line (if available)[2]	Photo Reference No.	Eelgrass Presence H/M/L[3]	Ground truthing P/A[4]
	Southern Labrador								
56	Islet Bay	52 12 53.04	55 42 31.33	High	–	–			
57	Horn Bay	52 13 10.39	55 45 17.80	High	–	–			
58	Horn Bay	52 12 09.11	55 46 47.41	High	–	–			
59	Kennedy Head	52 07 37.63	55 42 00.31	High	–	–			
60	Peter Bay	52 05 20.09	55 47 52.38	High	–	–			
61	Bad Bay	52 01 03.86	55 50 38.63	High	–	–			
62	Pitts Harbour	52 00 37.63	55 51 55.27	High	–	–			
63	Pitts Harbour	52 00 52.29	55 53 18.54	High	–	–			
64	Temple Bay	52 01 27.53	55 59 08.89	High	–	–			
65	Green Bay	51 51 09.25	56 07 42.80	High	–	–			
66	Barge Bay	51 48 29.89	56 12 32.33	High	–	–			
67	Black Bay	51 46 36.10	56 20 47.52	High	–	–			
68	Red Bay	51 44 05.86	56 26 32.17	High	–	–			
69	Pinware	51 39 27.34	56 42 03.12	High	–	–			
70	Pinware	51 38 34.51	56 42 25.18	High	–	–			
71	L'Anse Au Loup	51 31 30.31	56 48 52.97	High	–	–			
72	Forteau	51 29 10.56	56 56 56.45	High	–	–			
73	L'Anse Au Claire	51 25 32.54	57 03 26.39	High	–	–			
	Trinity Bay								
74	Little Catalina Harbour	48 32 19.62	53 02 28.68	High	–	N		H	
75	Near Catalina Harbour	48 30 59.4	53 03 51.84	High	–	N		H	

Site #	Geographic Location			High Potential Eelgrass Sites					
						Aerial Photographs			
	Location (nearest community)	Latitude dd mm ss.ss	Longitude Dd mm ss.ss	Google Earth Satellite Imagery	CCRI[1]	Flight Line (if available)[2]	Photo Reference No.	Eelgrass Presence H/M/L[3]	Ground truthing P/A[4]
76	Champney's Cove	48 23 24.36	53 17 54.6	High	Y	–			
77	Trinity	48 23 44.16	53 22 24.6	High	Y	–			P
78	near Trinity	48 22 46.92	53 22 48.36	High	Y	–			P
79	Goose Cove	48 22 04.08	53 22 31.44	High	Y	–			
80	Kerley's Harbour	48 17 06.36	53 26 53.52	High	–	88039	4	H	
81	Little Harbour	48 14 04.92	53 33 35.64	High	–	N		H	
82	Milton	48 13 27.84	53 57 27.36	High	Y	–			P
83	Shoal Harbour-1	48 12 06.12	53 57 31.32	High	Y	–			P
84	Shoal Harbour-2	48 12 00.72	53 57 43.92	High	Y	–			P
85	Clarenville-1	48 11 08.52	53 58 23.88	High	Y	88071	82, 25	H	P
86	Deep Bight	48 05 52.8	53 56 39.48	High	–	88075	98	H	P
87	Hickman's Harbour	48 06 26.64	53 44 44.52	High	–	N		H	
88	St. Jones Within	48 02 36.6	53 45 07.2	High	–	N			
89	Near Hillview	48 02 06.36	53 55 22.44	High	Y	N		H	P
90	Queen's Cove	48 00 52.56	53 56 15.72	High	Y	88075	50	H	A
91	Little Heart's Ease	48 01 08.76	53 40 57.72	High	Y	–			P
92	St. Jones Without	47 54 43.56	53 43 48.72	High	–	N		H	
93	Deer Harbour	47 54 16.92	53 48 50.04	High	Y	–			
94	Sunnyside	47 51 50.04	53 56 14.64	High	Y	–			P
95	Bull arm	47 51 04.68	53 55 55.92	High	–	N		H	
96	Little Mosquito	47 50 29.04	53 53 58.56	High	Y	–			P
97	Rantem Cove	47 41 54.96	53 51 20.52	High	–	N		H	
98	Broad Lake-Bellevue	47 37 51.24	53 45 32.04	High	Y	–			

Site #	Geographic Location			High Potential Eelgrass Sites					
						Aerial Photographs			
	Location (nearest community)	Latitude dd mm ss.ss	Longitude Dd mm ss.ss	Google Earth Satellite Imagery	CCRI[1]	Flight Line (if available)[2]	Photo Reference No.	Eelgrass Presence H/M/L[3]	Ground truthing P/A[4]
99	Bellevue	47 38 14.28	53 44 37.68	High	Y	–			
100	South of Thornlea	47 34 21.36	53 42 41.76	High	–	N		H	
101	Chapel Arm	47 31 07.32	53 40 14.88	High	–	N		H	
102	Spread Eagle Bay	47 32 08.16	5 35 46.32	High	Y	–			P
103	Old Shop	47 31 31.8	53 34 24.24	High	–	N		H	P
104	South Dildo	47 31 11.28	53 33 31.68	High	–	–			
105	Dildo	47 34 09.12	53 33 47.88	High	–	N		H	A
106	New Harbour	47 35 09.6	53 32 33.36	High	Y	–			P
107	Green's Harbour	47 38 24.36	53 30 28.44	High	Y	–			P
108	Heart's Delight	47 46 38.64	53 27 53.28	High	–	–			
109	Heart's Desire	47 48 43.2	53 26 35.52	High	–	N		H	
110	New Perlican	47 54 35.28	53 21 23.04	High	–	N		H	

[1]Y= Yes (eelgrass present) / – = no record available in CCRI
[2]N= No photo number available/ – = No photo existed or no photo examined
[3]H/M/L=High/Medium/Low eelgrass probability
[4]P/A=Presence/Absence of eelgrass (Blank cells mean no ground-truthing was performed)